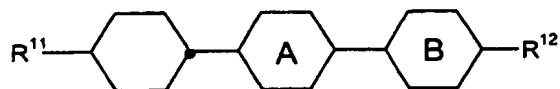


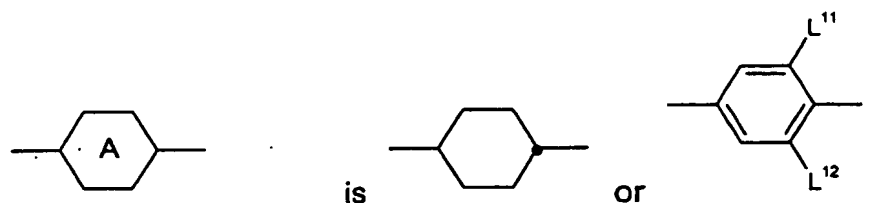
Claims

1. Use of a liquid crystal composition in a liquid crystal device said composition comprising
- 5
- at least 30 weight% (based on the total weight of the composition) of a component (α) containing one or more compounds having a dielectric anisotropy $\Delta\epsilon$ of at least 25, whereby at least 25 weight% (based on the total weight of the composition) of said compounds have a dielectric anisotropy $\Delta\epsilon$ of at least 40; and
 - 10
 - a component (δ) containing one or more compounds each having a ratio of γ_1/T_{NI}^K of 0.51 mPa·s/K or less, a clearing point T_{NI} of at least 100 °C and a rotational viscosity γ_1 of not more than 190 mPa·s (wherein γ_1 is the rotational viscosity at 20 °C in mPa·s and T_{NI}^K is the clearing point in degrees Kelvin).
 - 15
2. Use of a liquid crystal composition according to claim 1 whereby said liquid crystal device is a zenithal bistable nematic liquid crystal device.
- 20
3. Use of a liquid crystal composition according to any one of claims 1 or 2 whereby said component (δ) comprises at least one compound of formula I
- 25



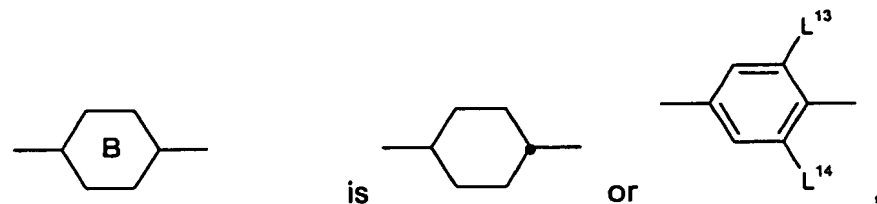
in which

R^{11} and R^{12} are independently of each other C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by $-O-$, $-S-$, $-CH=CH-$, $-C\equiv C-$, $-CO-O-$, $-OC-O-$ such that there are no hetero atoms adjacent to each other;



in which

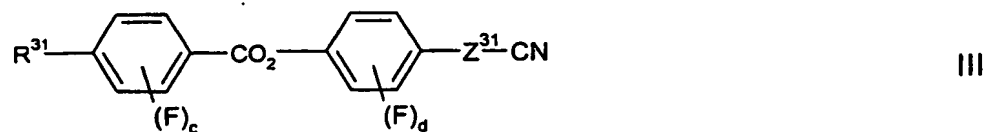
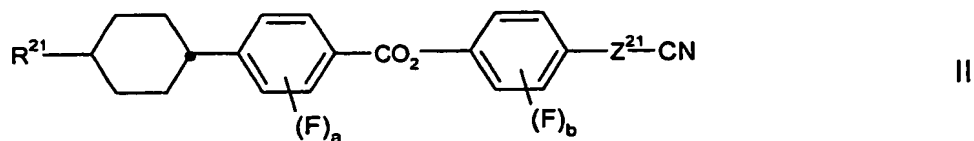
L^{11} and L^{12} are independently of each other H or F; and



in which

L^{13} and L^{14} are independently of each other H or F.

4. Use of a liquid crystal composition according to any one of claims 1 to 3 whereby said component (α) comprises at least one compound of formula II and/or at least one compound of formula III



in which

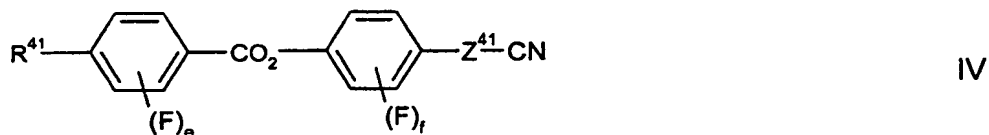
a, b, c and d are independently of each other 0, 1, 2, 3 or 4;

R^{21} is C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -CH=CH-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;

R^{31} is C_2 - C_{15} alkenyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -CH=CH-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;

Z^{21} and Z^{31} are independently of each other a single bond or -C≡C-.

5. Use of a liquid crystal composition according to claim 4 whereby said component (α) comprises at least one compound of formula IV



in which

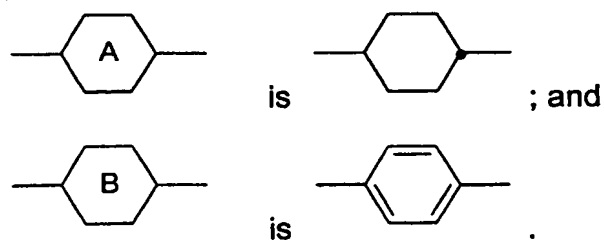
e and f are independently of each other 0, 1, 2, 3 or 4;

R^{41} is C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;

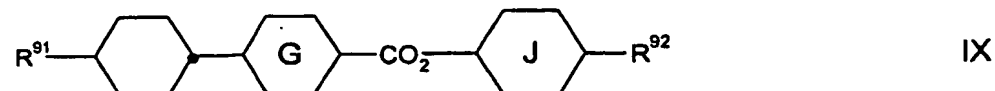
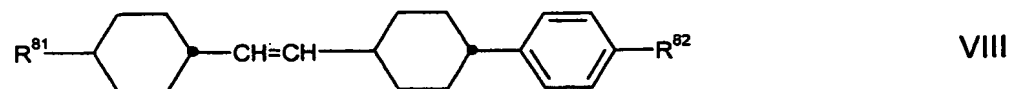
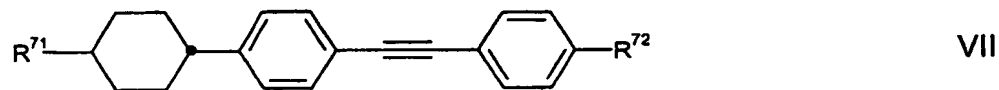
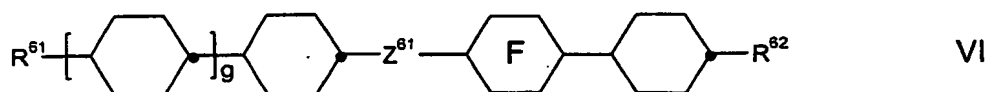
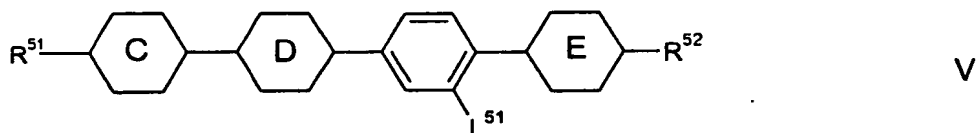
Z^{41} is a single bond or -C≡C-.

6. Use of a liquid crystal composition according to any one of claims 3 to 5 whereby in formula I

R^{11} is C_2-C_{15} alkenyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -CH=CH-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;



7. Use of a liquid crystal composition according to any one of claims 1 to 6 whereby said liquid crystal composition further comprises at least 5 weight% (based on the total weight of the composition) of a component (β) comprising at least one compound selected from the group consisting of compounds of formula V, VI, VII, VIII and IX



- 97 -

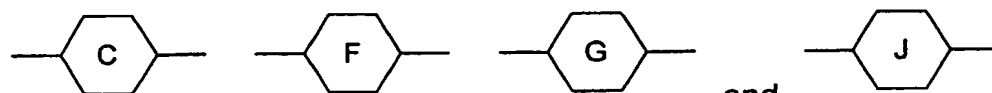
in which

g is 0 or 1;

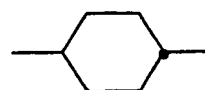
R^{51} , R^{52} , R^{61} , R^{62} , R^{71} , R^{72} , R^{81} , R^{82} , R^{91} and R^{92} are independently of each other C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -CH=CH-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;

L^{51} is H or F;

Z^{61} is -CO-O-, -CH₂O-, -OCH₂-, -CF₂O-, -OCF₂-, -CH₂CH₂-, -CF₂CF₂-, -CH₂CF₂-, -CF₂CH₂-, -CH=CH- or -C≡C-;

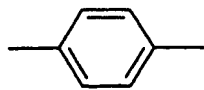


and

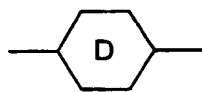


are independently of each other

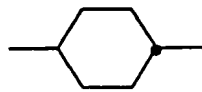
or



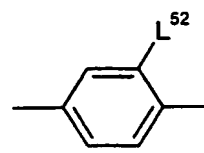
;



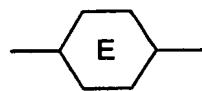
is



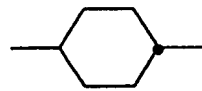
or



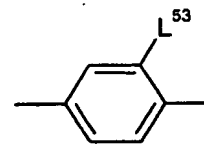
;



is



or



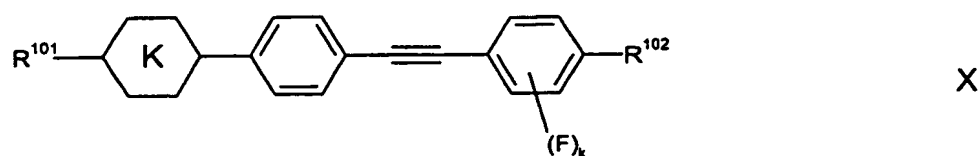
;

in which

L^{52} and L^{53} are independently of each other H or F.

8. Use of a liquid crystal composition according to any one of claims 1 to 7 whereby said liquid crystal composition further comprises at least 3 weight% (based on the total weight of the composition) of a component (γ) containing one or more compounds having an optical anisotropy Δn of at least 0.20.

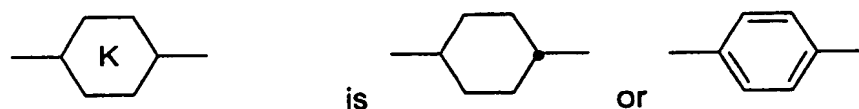
9. Use of a liquid crystal composition according to claim 8 whereby said component (γ) comprises at least one compound of formula X



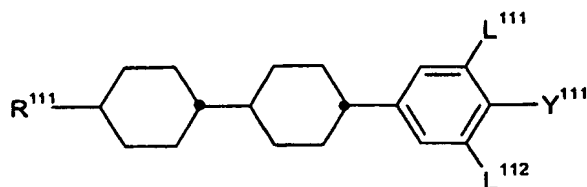
in which

k is 0, 1 or 2;

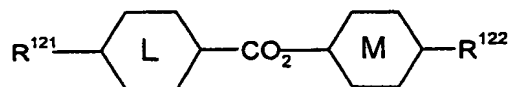
R^{101} and R^{102} are independently of each other C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced by -O-, -S-, -CH=CH-, -C \equiv C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other; and



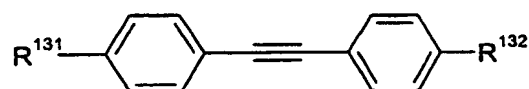
- 25 10. Use of a liquid crystal composition according to any one of claims 3 to 9 whereby said liquid crystal composition further comprises at least one compound of formula XI and/or at least one compound of formula XII and/or at least one compound of formula XIII at least one compound of formula XIV



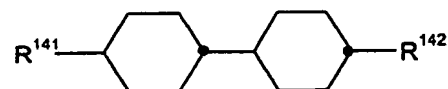
XI



XII



XIII



XIV

in which

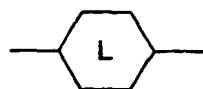
R^{111} and R^{142} are independently of each other C_2 - C_{15} alkenyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -CH=CH-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;

R^{121} , R^{131} , R^{132} and R^{141} are independently of each other C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -CH=CH-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;

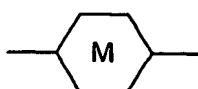
R^{122} is C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -CH=CH-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;

Y^{111} is F or Cl;

L^{111} and L^{112} are independently of each other H or F; and

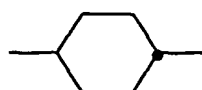


and

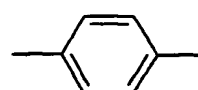


are independently of each

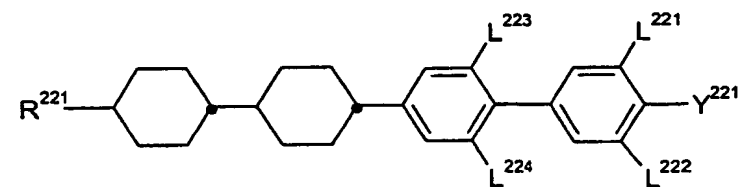
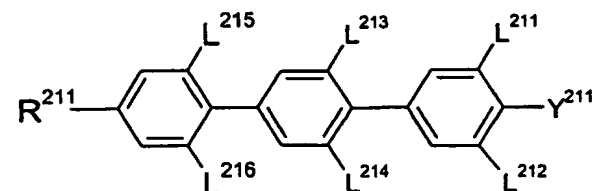
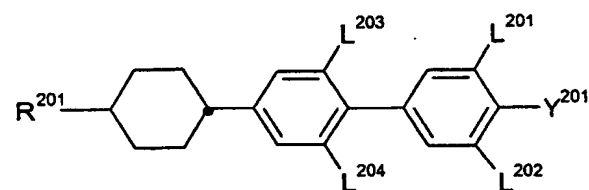
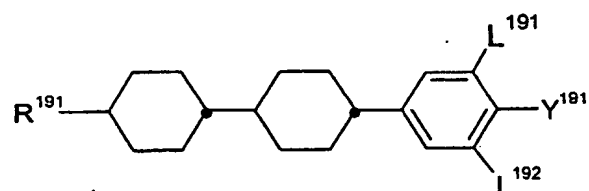
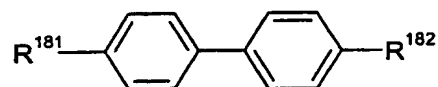
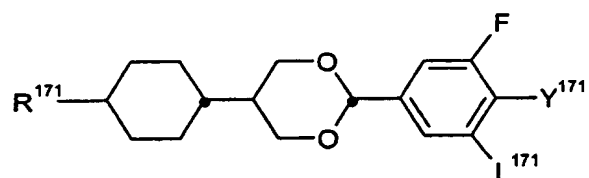
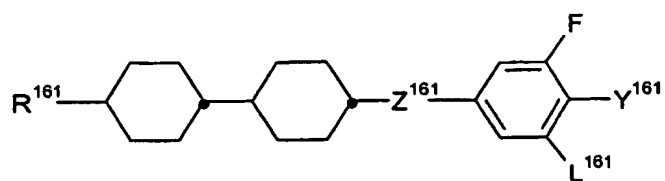
other



or



- 10 11. Use of a liquid crystal composition according to any one of claims 1 to 10 whereby said liquid crystal composition comprises at least 50 weight% (based on the total weight of the composition) of said component (α).
- 15 12. Use of a liquid crystal composition according to any one of claims 1 to 11 whereby said liquid crystal composition comprises at least 50 weight% (based on the total weight of the composition) of said component (α) whereby at least 30 weight% (based on the total weight of the composition) of said compounds have a dielectric anisotropy $\Delta\epsilon$ of at least 40.
- 20 13. Use of a liquid crystal composition according to any one of claims 1 to 12 whereby said liquid crystal composition comprises at least 5 weight% (based on the total weight of the composition) of said component (δ).
- 25 14. Use of a liquid crystal composition according to any one of claims 1 to 13 whereby said liquid crystal composition comprises at least one compound of formula XVI and/or XVII and/or of formula XVIII and/or of formula XIX and/or of formula XX and/or of formula XXI and/or of
- 30 formula XXII:



in which

$R^{161}, R^{171}, R^{181}, R^{182}, R^{201}, R^{211}$ and R^{221}

are independently of each other C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -CH=CH-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;

R^{191}

is C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;

$Y^{161}, Y^{171}, Y^{191}, Y^{201}, Y^{211}$ and Y^{221}

are independently of each other F, Cl, C_1 - C_{15} alkanyl or C_2 - C_{15} alkenyl that are independently of each other mono- or poly-substituted with halogen, or C_1 - C_{15} alkoxy, which is mono- or poly-substituted with halogen;

$L^{161}, L^{171}, L^{191}, L^{192}, L^{201}, L^{202}, L^{203}, L^{204}, L^{211}, L^{212}, L^{213}, L^{214}, L^{215}, L^{216}, L^{221}, L^{222}, L^{223}$ and L^{224}

are independently of each other H or F;

and

Z^{161}

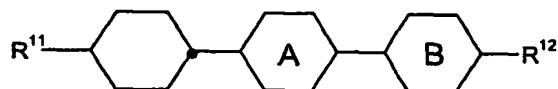
is -CO-O-, CH_2O or CF_2O .

15. Liquid crystal medium comprising

- at least 30 weight% (based on the total weight of the composition) of a component (α) containing one or more compounds having a dielectric anisotropy $\Delta\epsilon$ of at least 25, whereby at least 25 weight% (based on the total weight of the composition) of said compounds have a dielectric anisotropy $\Delta\epsilon$ of at least 40; and
- a component (δ) containing one or more compounds each having a ratio of γ_1/T_{NI}^K of 0.51 mPa·s/K or less, a clearing point T_{NI} of at least 100 °C and a rotational viscosity γ_1 of not more than 190 mPa·s (wherein γ_1 is the rotational viscosity at 20 °C in mPa·s and T_{NI}^K is the clearing point in degrees Kelvin).

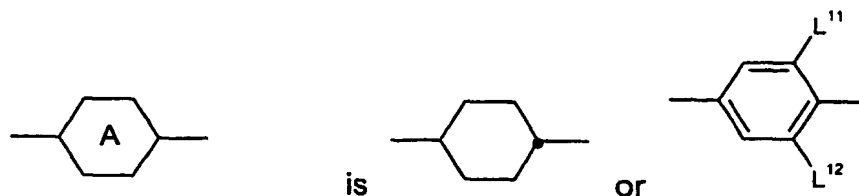
16. Liquid crystal medium according to claim 15 whereby

- said component (δ) comprises at least one compound of formula I



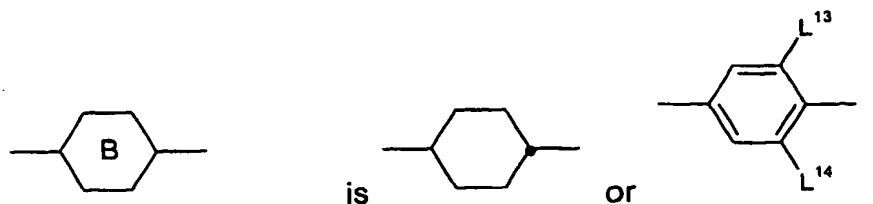
in which

R^{11} and R^{12} are independently of each other C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -CH=CH-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;



in which

L^{11} and L^{12} are independently of each other H or F; and

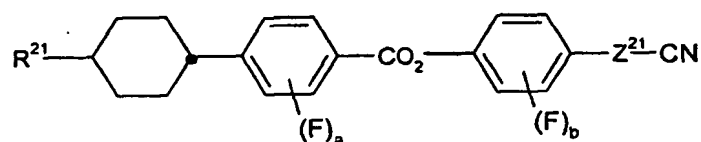


in which

L^{13} and L^{14} are independently of each other H or F;

and

- said component (α) comprises at least one compound of formula II



in which

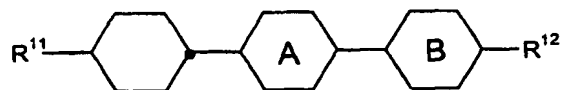
a and b are independently of each other 0, 1, 2, 3 or 4;

R^{21} is C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -CH=CH-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;

Z^{21} is a single bond or -C≡C-.

17. Liquid crystal medium according to claim 15 whereby

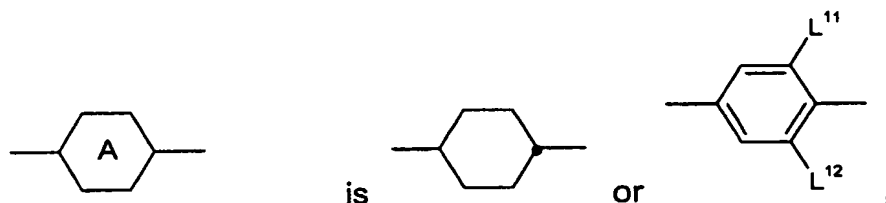
- said component (δ) comprises at least one compound of formula I



in which

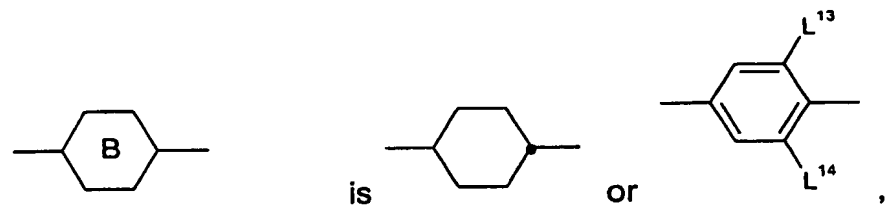
- 105 -

R^{11} and R^{12} are independently of each other C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by $-O-$, $-S-$, $-CH=CH-$, $-C\equiv C-$, $-CO-O-$, $-OC-O-$ such that there are no hetero atoms adjacent to each other;



in which

L^{11} and L^{12} are independently of each other H or F; and

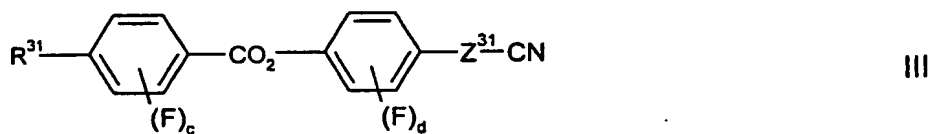


in which

L^{13} and L^{14} are independently of each other H or F;

and

- said component (α) comprises at least one compound of formula III



in which

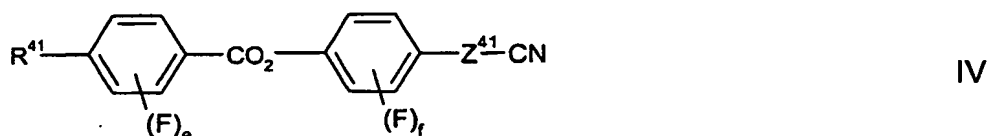
c and d are independently of each other 0, 1, 2, 3 or 4;

- 106 -

R^{31} is C_2-C_{15} alkenyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -CH=CH-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;

Z^{31} is a single bond or -C≡C-.

18. Liquid crystal medium according to any one of claims 16 or 17 whereby said component (α) further comprises at least one compound of formula IV



in which

e and f are independently of each other 0, 1, 2, 3 or 4;

R^{41} is C_1-C_{15} alkyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;

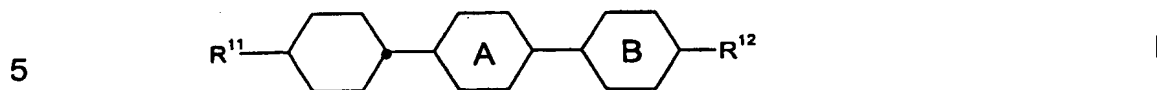
Z^{41} is a single bond or -C≡C-.

19. Bistable liquid crystal device comprising

- two outer substrates which, together with a frame, form a cell;
- a liquid crystal composition present in said cell;

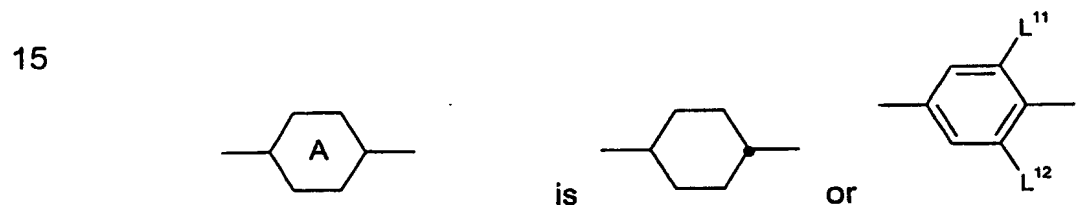
- 5
- electrode structures with alignment layers on the inside of said outer substrates whereby at least one alignment layer comprises an alignment grating that permits the compounds of said liquid crystal composition to adopt at least two different stable states whereby the assembly of said electrode structures with said alignment layers being such that a switching between the said at least two different stable states is achieved by applying suitable electric signals to said electrode structures;
 - whereby said liquid crystal composition comprises
 - 10 • at least 30 weight% (based on the total weight of the composition) of a component (α) containing one or more compounds having a dielectric anisotropy $\Delta\epsilon$ of at least 25, whereby at least 25 weight% (based on the total weight of the composition) of said compounds have a dielectric anisotropy $\Delta\epsilon$ of at least 40; and
 - 15 • a component (δ) containing one or more compounds having a ratio of γ_1/T_{NI}^K of 0.51 mPa·s/K or less, a clearing point T_{NI} of at least 100 °C and a rotational viscosity γ_1 of not more than 190 mPa·s (wherein γ_1 is the rotational viscosity at 20 °C in mPa·s and T_{NI}^K is the clearing point in degrees Kelvin).
- 20
20. Bistable liquid crystal device according to claim 19 whereby
- said device is a zenithal bistable nematic liquid crystal device; and
 - 25 ▪ said electrode structures with alignment layers on the inside of said outer substrates have at least one alignment layer that comprises an alignment grating that permits the compounds of said liquid crystal composition to adopt at least two different stable states with different pretilt angles in the same azimuthal plane.
- 30

21. Bistable liquid crystal device according to any one of claims 19 or 20 whereby said component (δ) comprises at least one compound of formula I



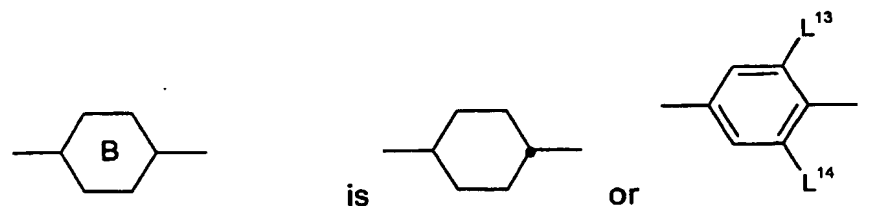
in which

10 R^{11} and R^{12} are independently of each other C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by $-O-$, $-S-$, $-CH=CH-$, $-C\equiv C-$, $-CO-O-$, $-OC-O-$ such that there are no hetero atoms adjacent to each other;



in which

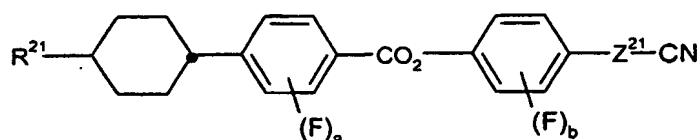
20 L^{11} and L^{12} are independently of each other H or F; and



in which

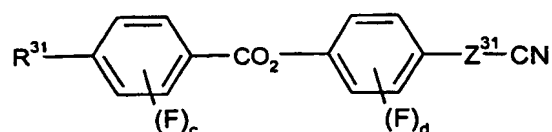
L^{13} and L^{14} are independently of each other H or F.

22. Zenithal bistable nematic liquid crystal device according to any one of claims 19 or 21 whereby said component (α) comprises at least one compound of formula II and/or at least one compound of formula III
- 30



II

5



III

in which

a, b, c and d are independently of each other 0, 1, 2, 3 or 4;

10

R^{21} is C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -CH=CH-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;

15

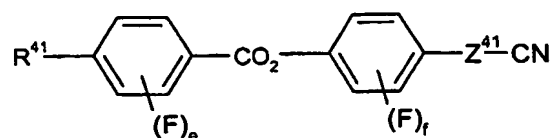
R^{31} is C_2 - C_{15} alkenyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -CH=CH-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;

20

Z^{21} and Z^{31} are independently of each other a single bond or -C≡C-.

23. Zenithal bistable nematic liquid crystal device according to claim 22 whereby said component (α) comprises at least one compound of formula IV

25



IV

30

in which

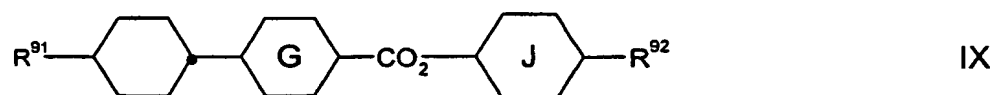
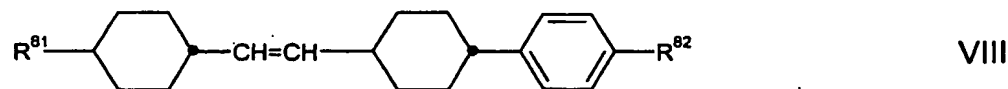
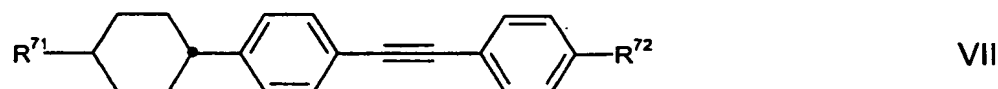
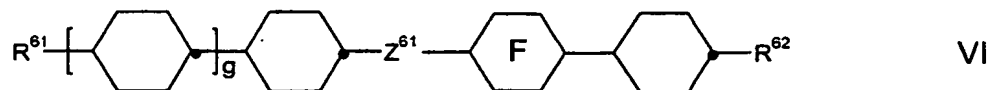
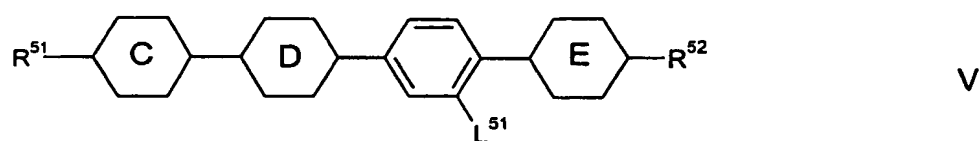
e and f are independently of each other 0, 1, 2, 3 or 4;

R^{41} is C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, $-C\equiv C-$, $-CO-O-$, $-OC-O-$ such that there are no hetero atoms adjacent to each other;

Z^{41} is a single bond or $-C\equiv C-$.

24. Zenithal bistable nematic liquid crystal device according to any one of claims 21 to 23 whereby said liquid crystal composition further comprises

- at least 5 weight% (based on the total weight of the composition) of a component (β) comprising at least one compound selected from the group consisting of compounds of formula V, VI, VII, VIII and IX



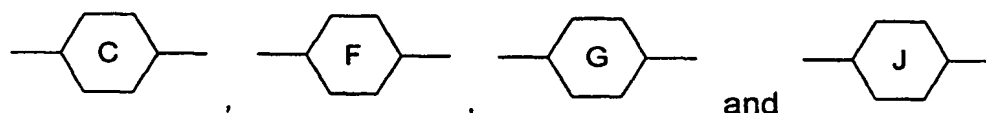
in which

g is 0 or 1;

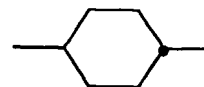
R^{51} , R^{52} , R^{61} , R^{62} , R^{71} , R^{72} , R^{81} , R^{82} , R^{91} and R^{92} are independently of each other C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -CH=CH-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;

L^{51} is H or F;

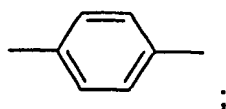
Z^{61} is -CO-O-, -CH₂O-, -OCH₂-, -CF₂O-, -OCF₂-, -CH₂CH₂-, -CF₂CF₂-, -CH₂CF₂-, -CF₂CH₂-, -CH=CH- or -C≡C-;



are independently of each other



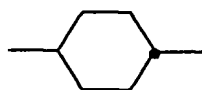
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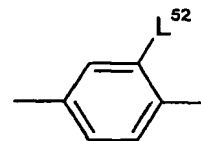
;



is



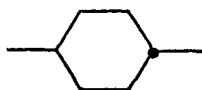
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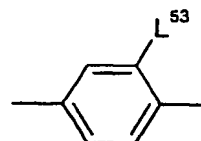
;



is



or



;

in which

L^{52} and L^{53}

are independently of each other H or F.

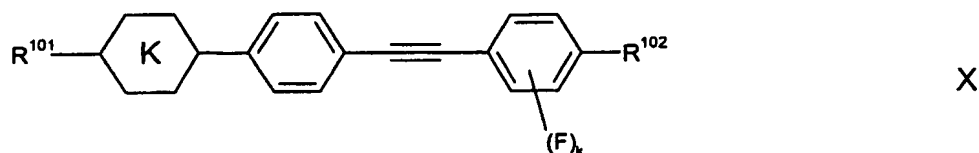
25. Zenithal bistable nematic liquid crystal device according to any one of claims 19 to 24 whereby said liquid crystal composition further comprises

- at least 3 weight% (based on the total weight of the composition) of a component (γ) containing one or more compounds having an optical anisotropy Δn of at least 0.20.

5

26. Zenithal bistable nematic liquid crystal device according to claim 25 whereby said component (γ) comprises at least one compound of formula X

10



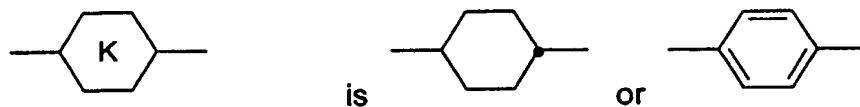
in which

15

k is 0, 1 or 2;

R^{101} and R^{102} are independently of each other C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced by -O-, -S-, -CH=CH-, -C \equiv C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other; and

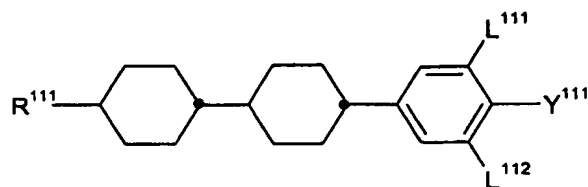
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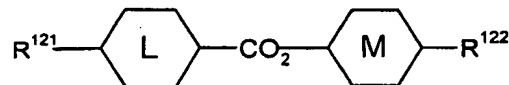
25

27. Zenithal bistable nematic liquid crystal device according to any one of claims 21 to 26 whereby said liquid crystal composition further comprises at least one compound of formula XI and/or at least one compound of formula XII and/or at least one compound of formula XIII at least one compound of formula XIV

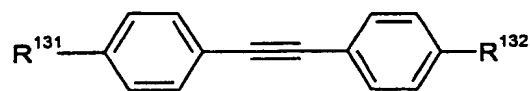
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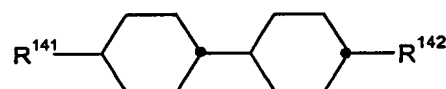
XI



XII



XIII



XIV

in which

R^{111} and R^{142} are independently of each other C_2 - C_{15} alkenyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -CH=CH-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;

R^{121} , R^{131} , R^{132} and R^{141} are independently of each other C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -CH=CH-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;

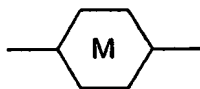
R^{122} is C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -CH=CH-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;

Y^{111} is F or Cl;

L^{111} and L^{112} are independently of each other H or F; and

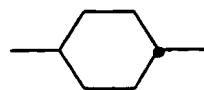


and

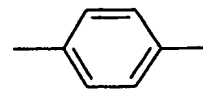


are independently of each

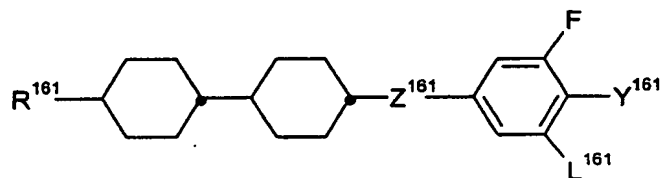
other



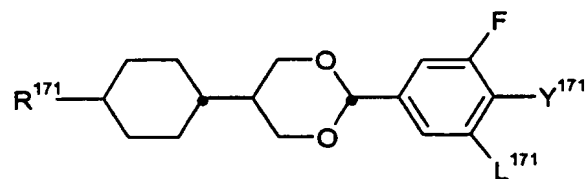
or



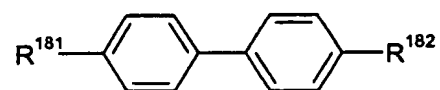
28. Bistable liquid crystal device according to any one of claims 19 to 27 whereby said liquid crystal composition comprises at least one compound of formula XVI and/or XVII and/or of formula XVIII and/or of formula XIX and/or of formula XX and/or of formula XXI and/or of formula XXII:



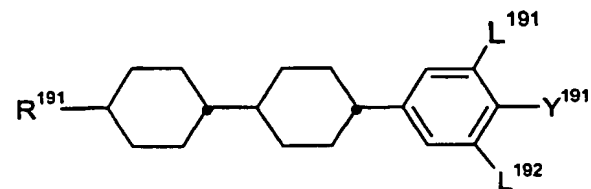
XVI



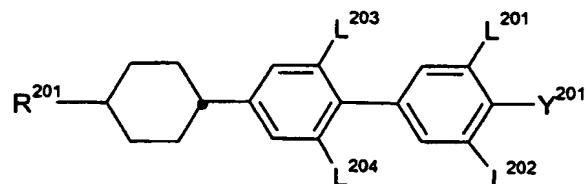
XVII



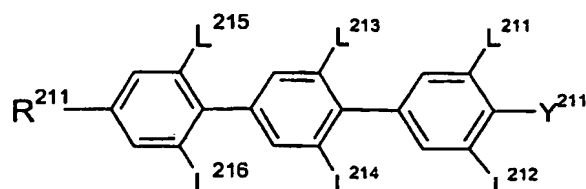
XVIII



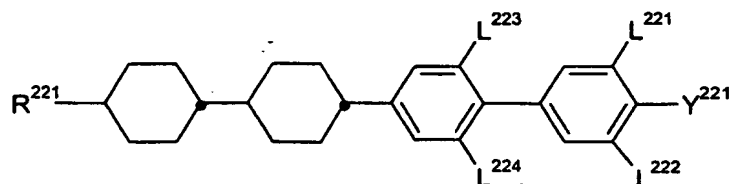
XIX



XX



XXI



XXII

in which

R^{161} , R^{171} , R^{181} , R^{182} , R^{201} , R^{211} and R^{221}

are independently of each other C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -CH=CH-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;

R^{191}

is C_1 - C_{15} alkyl which is unsubstituted or mono- or poly-substituted with CN or halogen and in which one or more of the CH_2 groups may be replaced independently of each other by -O-, -S-, -C≡C-, -CO-O-, -OC-O- such that there are no hetero atoms adjacent to each other;

Y^{161} , Y^{171} , Y^{191} , Y^{201} , Y^{211} and Y^{221} are independently of each other F, Cl, C₁-C₁₅ alkanyl or C₂-C₁₅ alkenyl that are independently of each other mono- or poly-substituted with halogen, or C₁-C₁₅ alkoxy, which is mono- or poly-substituted with halogen;

L^{161} , L^{171} , L^{191} , L^{192} , L^{201} , L^{202} , L^{203} , L^{204} , L^{211} , L^{212} , L^{213} , L^{214} , L^{215} , L^{216} , L^{221} , L^{222} , L^{223} and L^{224} are independently of each other H or F;

and

Z^{161} is -CO-O-, CH₂O or CF₂O.